1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Ford Motor Company - Dearborn, Michigan contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the Wing A Dynamometer Test Cells (FG_WINGA/FGTESTCELLS) at the Ford Motor Company - Research and Engineering Center (State Registration No.: B6230) located in Dearborn, Michigan. The tests were conducted to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit No. MI-PTI-194-15.

The specific objectives were to:

- Verify the carbon monoxide (CO) and volatile organic compounds / total gaseous organics (VOC/TGO) destruction efficiency (DE) of RTO 1000, RTO 2000, and RTO 3000 serving FG_WINGA/FGTESTCELLS
- Verify the nitrogen oxides (NO_x) (as NO_2), CO, and VOC emissions (lb/MMBtu) of RTO 1000, 2000, and 3000
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

TABLE 1-1
SUMMARY OF TEST PROGRAM

Test Date(s)	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
07/07/2020 07/08/2020 07/09/2020	RTO 3000 RTO 2000 RTO 1000	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	~10 (Inlet) ~10 (Exhaust)
07/07/2020 07/08/2020 07/09/2020	RTO 3000 RTO 2000 RTO 1000	O_2, CO_2	EPA 3	3	~3 (Inlet)
07/07/2020 07/08/2020 07/09/2020	RTO 3000 RTO 2000 RTO 1000	Moisture	EPA 4	3	60 (Inlet) 60 (Exhaust)
07/07/2020 07/08/2020 07/09/2020	RTO 3000 RTO 2000 RTO 1000	CO	EPA 10	3	60 (Inlet) 60 (Exhaust)
07/07/2020 07/08/2020 07/09/2020	RTO 3000 RTO 2000 RTO 1000	VOC	EPA 25A	3	60 (Inlet) 60 (Exhaust)
07/07/2020 07/08/2020 07/09/2020	RTO 3000 RTO 2000 RTO 1000	O_2, CO_2	EPA 3A	3	60 (Exhaust)

07/07/2020 07/08/2020 07/09/2020	RTO 3000 RTO 2000 RTO 1000	NOx	EPA 7E	3	60 (Exhaust)

The testing was conducted by the Montrose personnel listed in Table 1-2.

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location: Ford Motor Company
Research and Engineering Center (B6230)
Dearborn, Michigan
Project Contact: Susan Hicks
Title Environmental Engineer
Company: Ford Motor Company
Telephone: 313-594-3185
Email: shicks3@ford.com

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Matthew Young	Steve Smith
Title:	District Manager	Client Project Manager
Telephone:	586-744-9133	734-751-9701
Email:	myoung@montrose-env.com	ssmith@montrose-env.com

Test personnel and observers are summarized in Table 1-2.

TABLE 1-2
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Steve Smith	Montrose	Client Project Manager, QI
Mike Nummer	Montrose	Field Technician
Benjamin Durham	Montrose	Field Technician
Susan Hicks	Ford Motor Company - Dearborn	Observer/Client Liaison/Test Coordinator

2.0 SUMMARY OF RESULTS

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility (SRN: B6230) and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to EGLE Permit No. MI-PTI-194-15. limits in Tables 2-1 through 2-4. Detailed results for individual test runs can be found in Section 5.0. All supporting data (including process data) can be found in the appendices. During this test at least six of the sixteen Durability Dynamometer Test Cells were in operation. See Appendix B for details.

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

2.0 SUMMARY OF RESULTS

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility (SRN: B6230) and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to EGLE Permit No. MI-PTI-194-15. limits in Tables 2-1 through 2-4. Detailed results for individual test runs can be found in Section 5.0. All supporting data (including process data) can be found in the appendices. During this test at least six of the sixteen Durability Dynamometer Test Cells were in operation. See Appendix B for details.

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

TABLE 2-1
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
FG_WING A
JULY 7-9, 2020

Parameter/Units	Total Results	Emission Limits
CO		
lb/MMBtu	1.1525	3.0308
NO_x (as NO_2)		
lb/MMBtu	1.48	-
VOC		
lb/MMBtu*	<0.0501	0.0569

* See Section 5.2 for details.

TABLE 2-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
FGTESTCELLS/RTO 1000
JULY 9, 2020

Parameter/Units	Average Results	Emission Limits
CO Destruction Efficiency (DE)		
%	97.7	95
VOC (TGO) Destruction Efficiency (DE)		
%	97.4	95

* One engine was burning diesel as fuel while the other engines were burning gasoline.

**TABLE 2-3
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
FGTESTCELLS/RTO 2000
JULY 8, 2020**

Parameter/Units	Average Results	Emission Limits
CO Destruction Efficiency (DE)		
%	97.8	95
VOC (TGO) Destruction Efficiency (DE)		
%	>97.3	95

* One engine was burning diesel as fuel while the other engines were burning gasoline.

**TABLE 2-4
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
FGTESTCELLS/RTO 3000
JULY 7, 2020**

Parameter/Units	Average Results	Emission Limits
CO Destruction Efficiency (DE)		
%	98.1	95
VOC (TGO) Destruction Efficiency (DE)		
%	>99.0	95

* All engines were burning gasoline.

**TABLE 2-5
SUMMARY OF OXIDZER AND CHAMBER TEMPERATURES -
JULY 7, 2020**

Parameter/Units	Setpoint °F	Average Chamber Temperature °F
RTO 1000	1580	1581
RTO 2000	1580	1581
RTO 3000	1580	1576

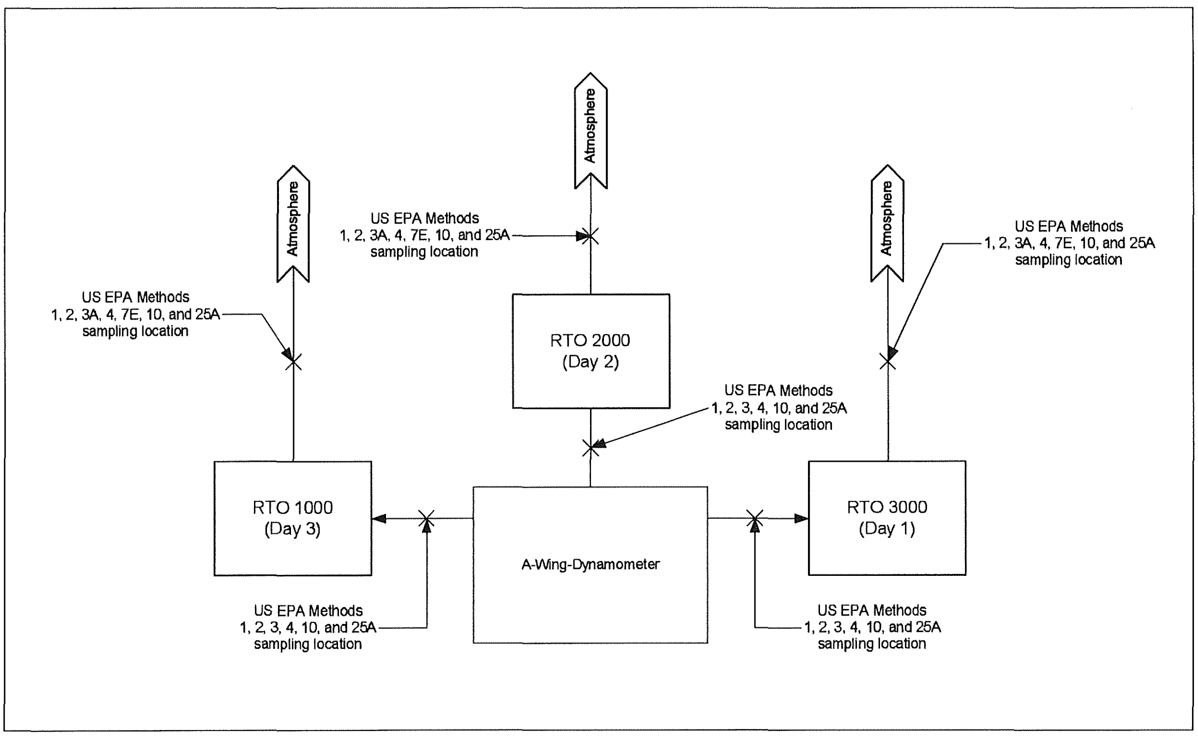
3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

3.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The Ford Motor Company Research and Engineering Center operates sixteen Durability Dynamometer Test Cells located in the Wing A Laboratory. Emissions from these dynamometers are controlled by three RTOs. During this test at least six of the sixteen Durability Dynamometer Test Cells were in operation. See the process data in Appendix B for more details.

The Sampling Location Schematic is displayed in Figure 3-1.

FIGURE 3-1
RTO 1000, RTO 2000, AND RTO 3000 SAMPLING LOCATION SCHEMATIC



3.2 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while the source/units and air pollution control devices were operating at the conditions required by the permit. The unit(s) were tested when operating normally.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- Location/Room
- Operating Condition
- Engine Displacement, L
- Fuel Type
- Fuel Mass Used, lb
- Fuel Mass Used, kg
- Density, lb/gal
- Specific Gravity
- Fuel Used, gal
- Heating Value BTU/lb
- Fuel Used, BTU
- Fuel, MMBTU/hr
- After Treatment
- Engine Operating Data
- PCV, %
- PT, in. WC
- PT, HZ
- Ramp (Set Point), °F
- Control Temp, °F
- Retention Time, hr

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 TEST METHODS

The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

4.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

The sample port and traverse point locations are detailed in Appendix A.

4.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1.

4.1.3 EPA Method 3, Gas Analysis for the Determination of Dry Molecular Weight

EPA Method 3 is used to calculate the dry molecular weight of the stack gas using one of three methods. The first choice is to measure the percent O_2 and CO_2 in the gas stream. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2 and percent O_2 using either an Orsat or a Fyrite analyzer.

4.1.4 EPA Method 3A, Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O_2 and CO_2 in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O_2 and CO_2. The performance requirements of the method must be met to validate data.

The typical sampling system is detailed in Figure 4-2.

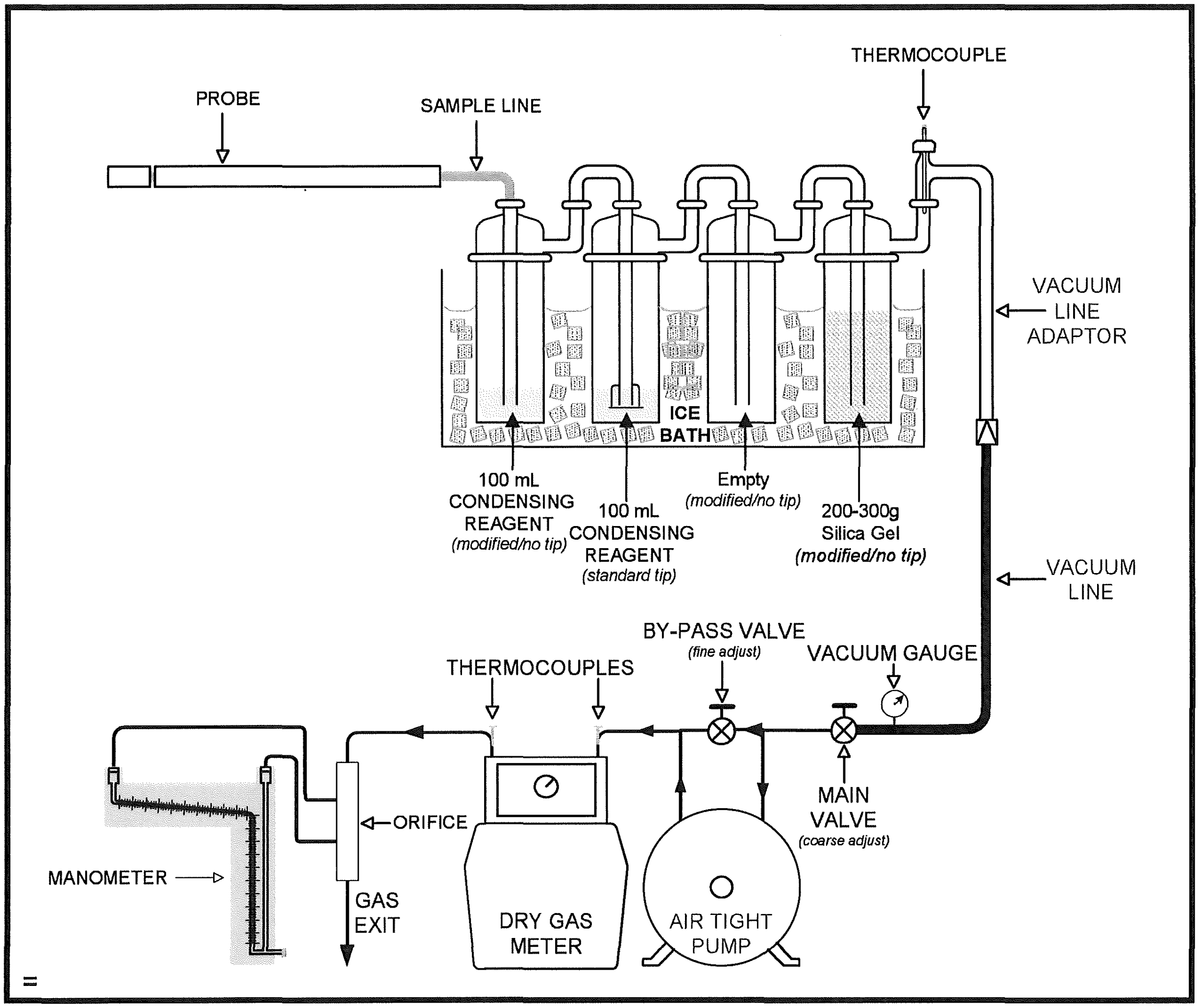
4.1.5 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train.

Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

The typical sampling system is detailed in Figure 4-1.

FIGURE 4-1
US EPA METHOD 4 (DETACHED) SAMPLING TRAIN



4.1.6 EPA Method 7E, Determination of Nitrogen Oxides Emissions from Stationary Source (Instrumental Analyzer Procedure)

EPA Method 7E is an instrumental test method used to continuously measure emissions of NO_x as NO_2. Conditioned gas is sent to an analyzer to measure the concentration of NO_x. NO and NO_2 can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO_2. The performance requirements of the method must be met to validate the data.

The typical sampling system is detailed in Figure 3-3.

4.1.7 EPA Method 10, Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 10 is an instrumental test method used to continuously measure emissions of CO. Conditioned gas is sent to an analyzer to measure the concentration of CO. The performance requirements of the method must be met to validate the data.

The typical sampling system is detailed in Figures 3-2 (RTO Inlet) and 3-3 (RTO Exhaust).

4.1.8 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

The typical sampling system is detailed in Figures 4-2 (RTO Inlet) and 4-3 (RTO Exhaust).

FIGURE 4-2
EPA METHOD 10 AND 25A SAMPLING TRAIN

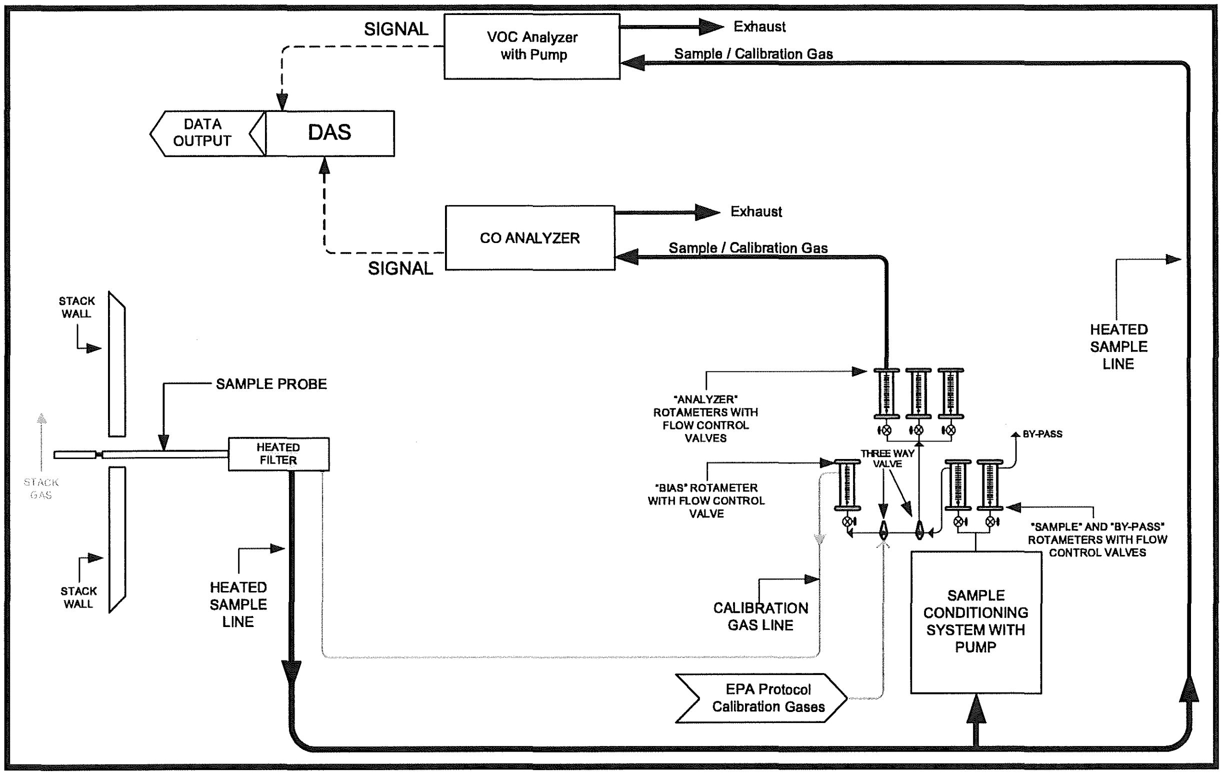
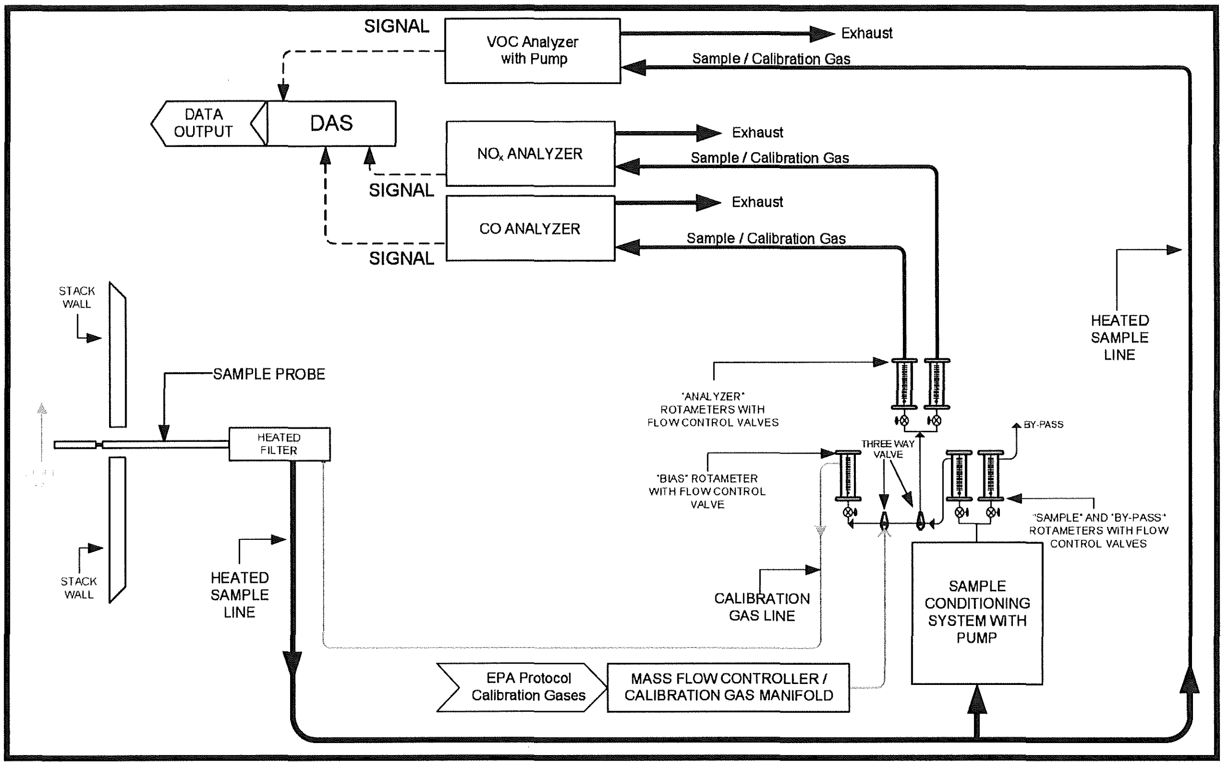


FIGURE4-3
EPA METHOD 7E, 10, AND 25A SAMPLING TRAIN



4.2 FLUE GAS SAMPLING LOCATION(S)

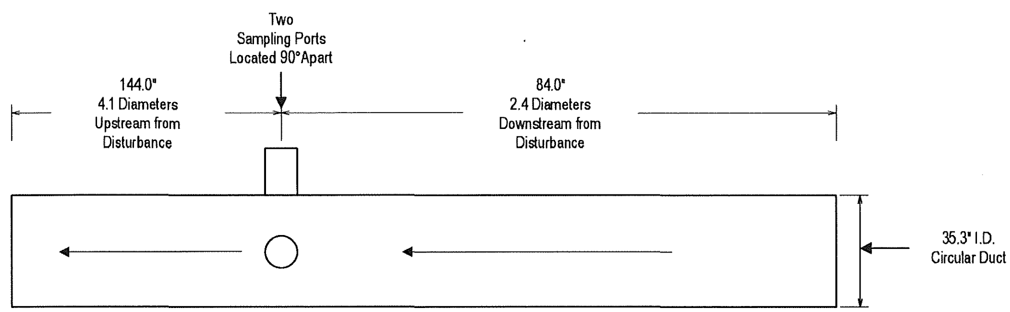
Information regarding the sampling location(s) is presented in Table 4-1.

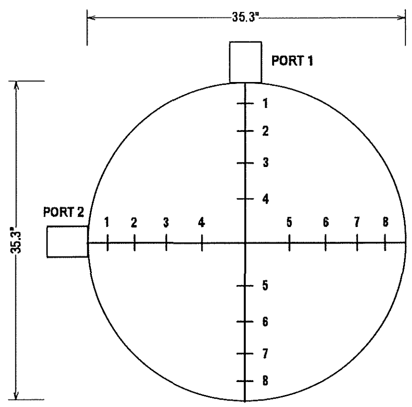
TABLE 4-1
SAMPLING LOCATION(S)

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance Downstream EPA "B" (in./dia.)	Distance from Nearest Disturbance Upstream EPA "A" (in./dia.)	Number of Traverse Points
RTO 1000 Inlet Duct	35.3	84.0 / 2.4	144.0 / 4.1	Flow: 16 (8/port); Gaseous 12 (6/port)
RTO 1000 Exhaust Stack	49.3	156.0 / 3.2	144.0 / 2.9	Flow: 16 (8/port); Gaseous 12 (6/port)
RTO 2000 Inlet Duct	35.3	84.0 / 2.4	144.0 / 4.1	Flow: 16 (8/port); Gaseous 12 (6/port)
RTO 2000 Exhaust Stack	49.3	156.0 / 3.2	144.0 / 2.9	Flow: 16 (8/port); Gaseous 12 (6/port)
RTO 3000 Inlet Duct	35.3	84.0 / 2.4	144.0 / 4.1	Flow: 16 (8/port); Gaseous 12 (6/port)
RTO 3000 Exhaust Stack	49.3	156.0 / 3.2	144.0 / 2.9	Flow: 16 (8/port); Gaseous 12 (6/port)

Sample location(s) were verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See A.2 for more information. The Traverse Point Location Drawings for each sampling location are located in Tables 4-4 through 4-15.

FIGURE4-4
RTO 1000 INLET FLOW TRAVERSE POINT LOCATION DRAWING





Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	1.1	1.1
2	10.5	3.7	3.7
3	19.4	6.8	6.8
4	32.3	11.4	11.4
5	67.7	23.9	23.9
6	80.6	28.4	28.4
7	89.5	31.5	31.5
8	96.8	34.1	34.1

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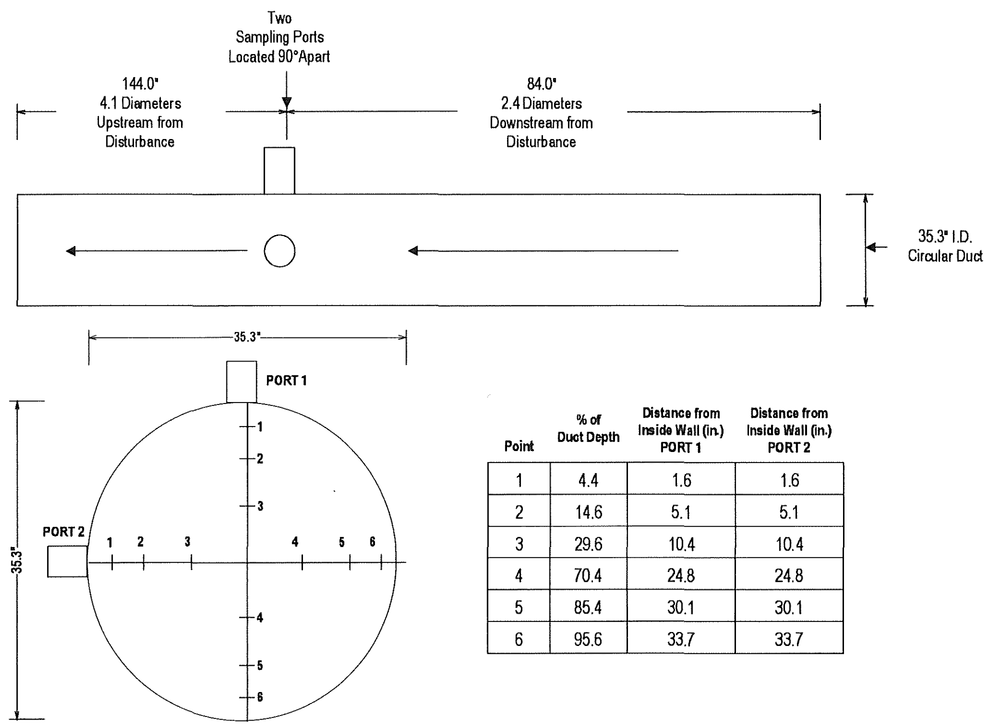
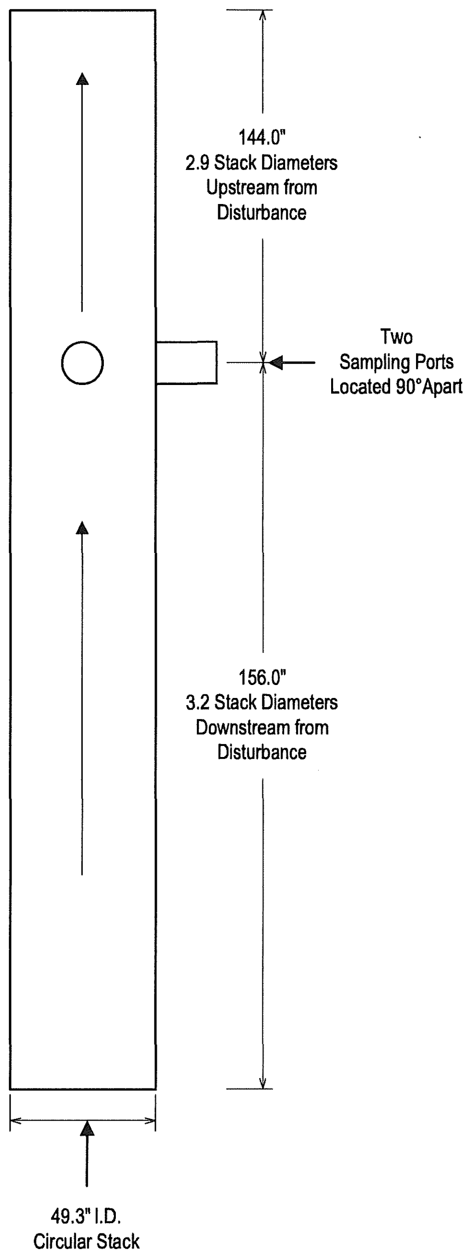
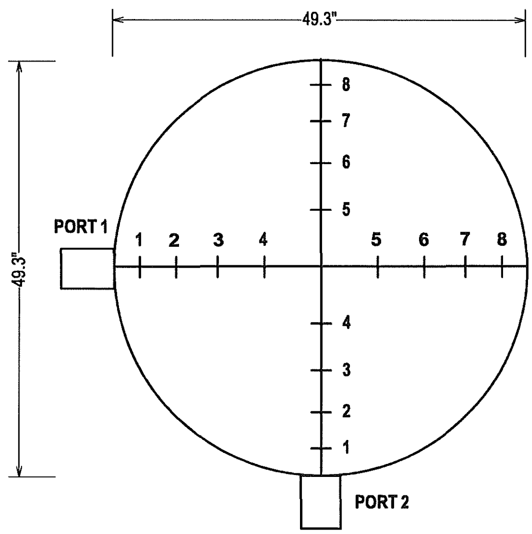
FIGURE4-5
RTO 1000 INLET CEMS TRAVERSE POINT LOCATION DRAWING



Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	1.6	1.6
2	14.6	5.1	5.1
3	29.6	10.4	10.4
4	70.4	24.8	24.8
5	85.4	30.1	30.1
6	95.6	33.7	33.7

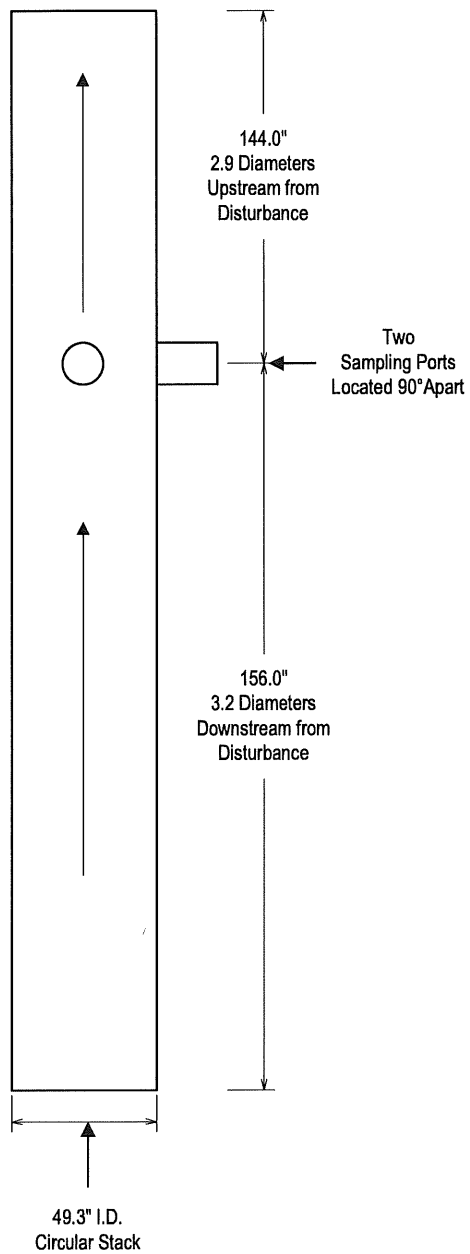
FIGURE4-6
RTO 1000 EXHAUST FLOW TRAVERSE POINT LOCATION DRAWING

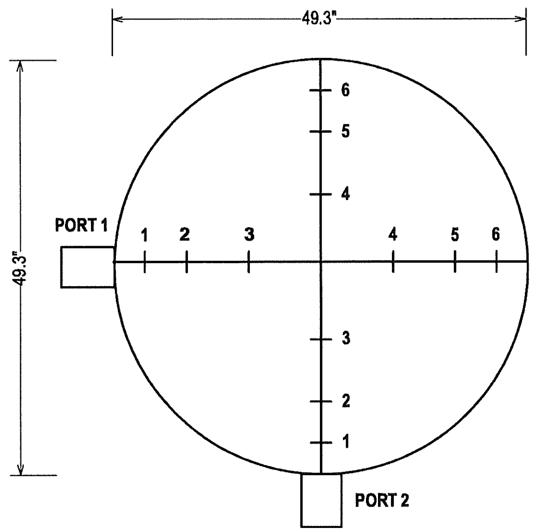




Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	1.6	1.6
2	10.5	5.2	5.2
3	19.4	9.6	9.6
4	32.3	15.9	15.9
5	67.7	33.3	33.3
6	80.6	39.7	39.7
7	89.5	44.1	44.1
8	96.8	47.7	47.7

FIGURE4-7
RTO 1000 EXHAUST CEMS TRAVERSE POINT LOCATION DRAWING





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	2.2	2.2
2	14.6	7.2	7.2
3	29.6	14.6	14.6
4	70.4	34.7	34.7
5	85.4	42.1	42.1
6	95.6	47.1	47.1

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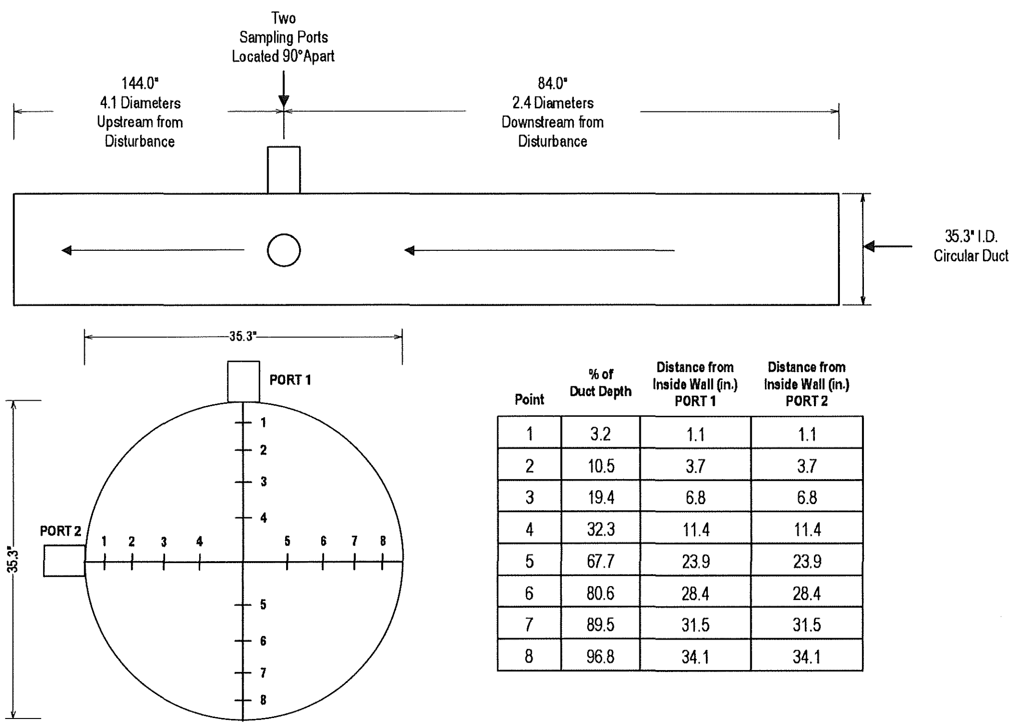
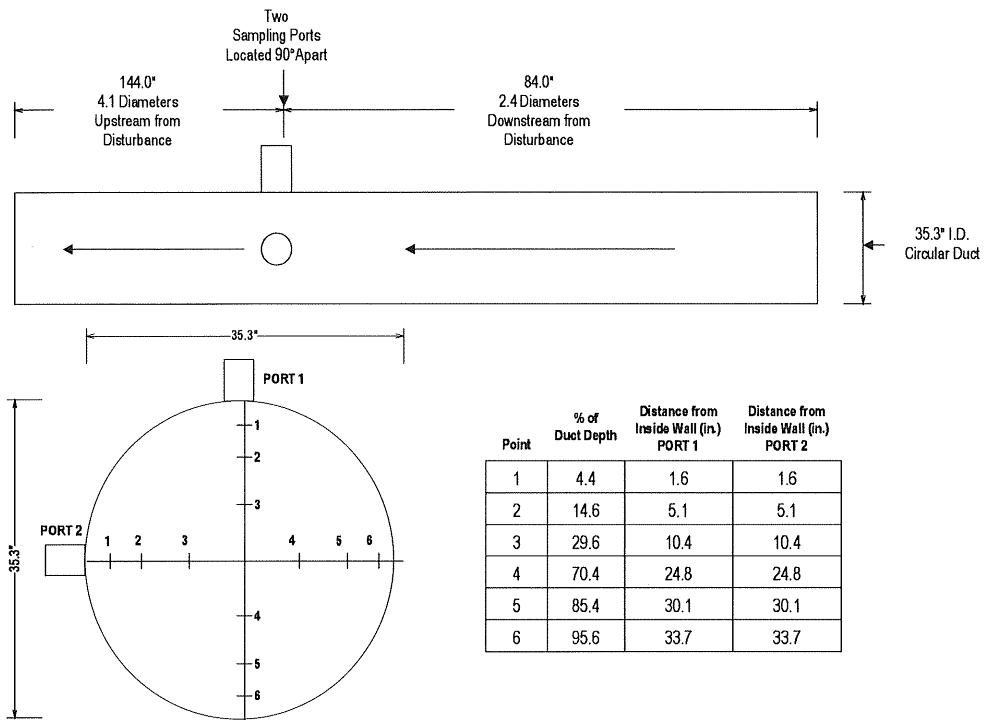
FIGURE4-8
RTO 2000 INLET FLOW TRAVERSE POINT LOCATION DRAWING



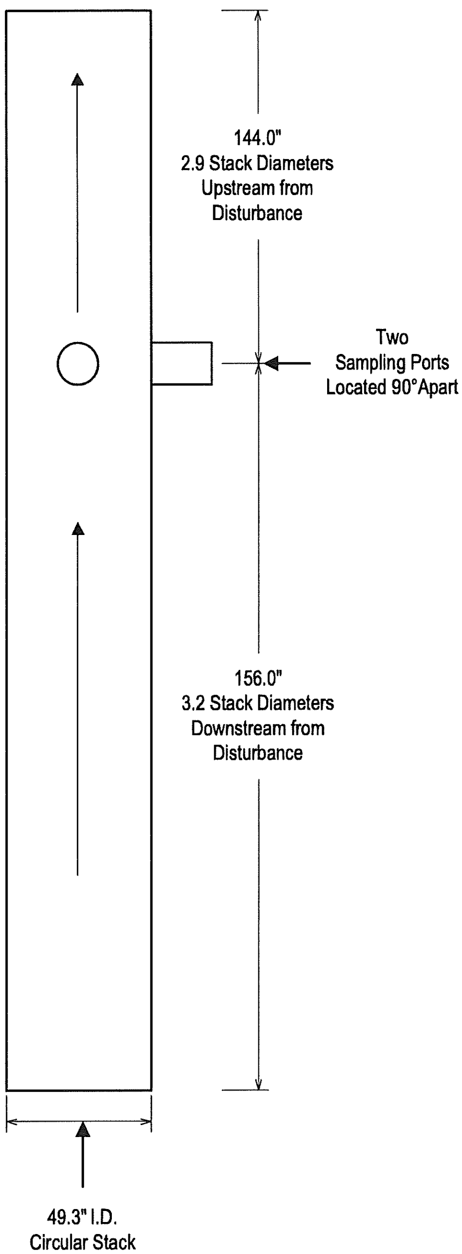
Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	1.1	1.1
2	10.5	3.7	3.7
3	19.4	6.8	6.8
4	32.3	11.4	11.4
5	67.7	23.9	23.9
6	80.6	28.4	28.4
7	89.5	31.5	31.5
8	96.8	34.1	34.1

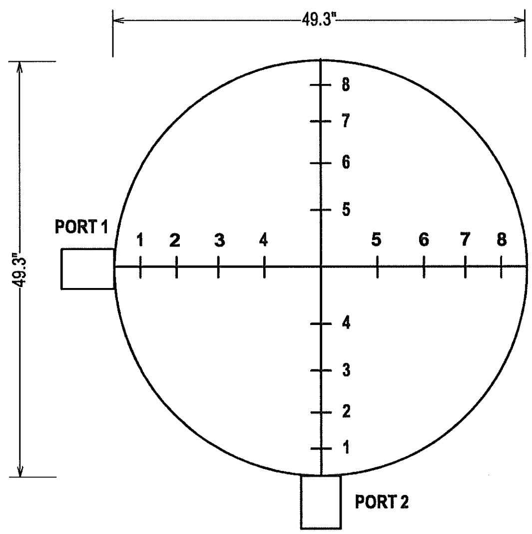
FIGURE4-9
RTO 2000 INLET CEMS TRAVERSE POINT LOCATION DRAWING



Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	1.6	1.6
2	14.6	5.1	5.1
3	29.6	10.4	10.4
4	70.4	24.8	24.8
5	85.4	30.1	30.1
6	95.6	33.7	33.7

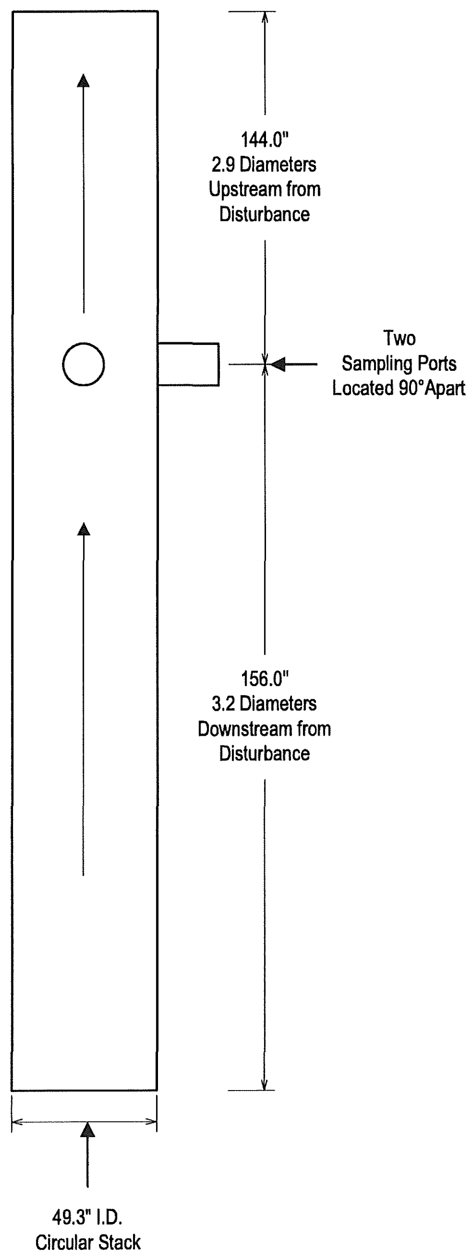
FIGURE4-10
RTO 2000 EXHAUST FLOW TRAVERSE POINT LOCATION DRAWING

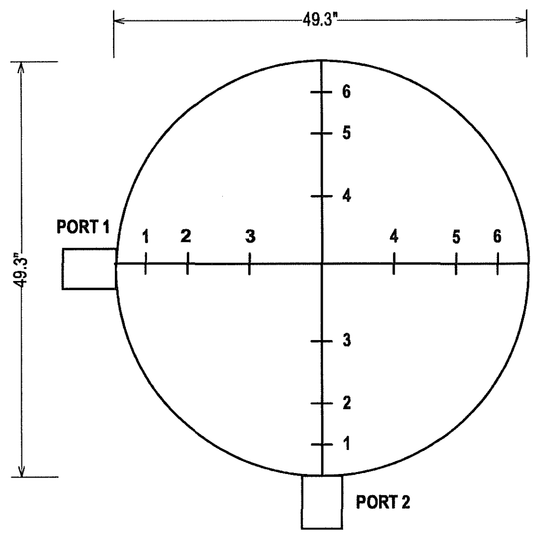




Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	1.6	1.6
2	10.5	5.2	5.2
3	19.4	9.6	9.6
4	32.3	15.9	15.9
5	67.7	33.3	33.3
6	80.6	39.7	39.7
7	89.5	44.1	44.1
8	96.8	47.7	47.7

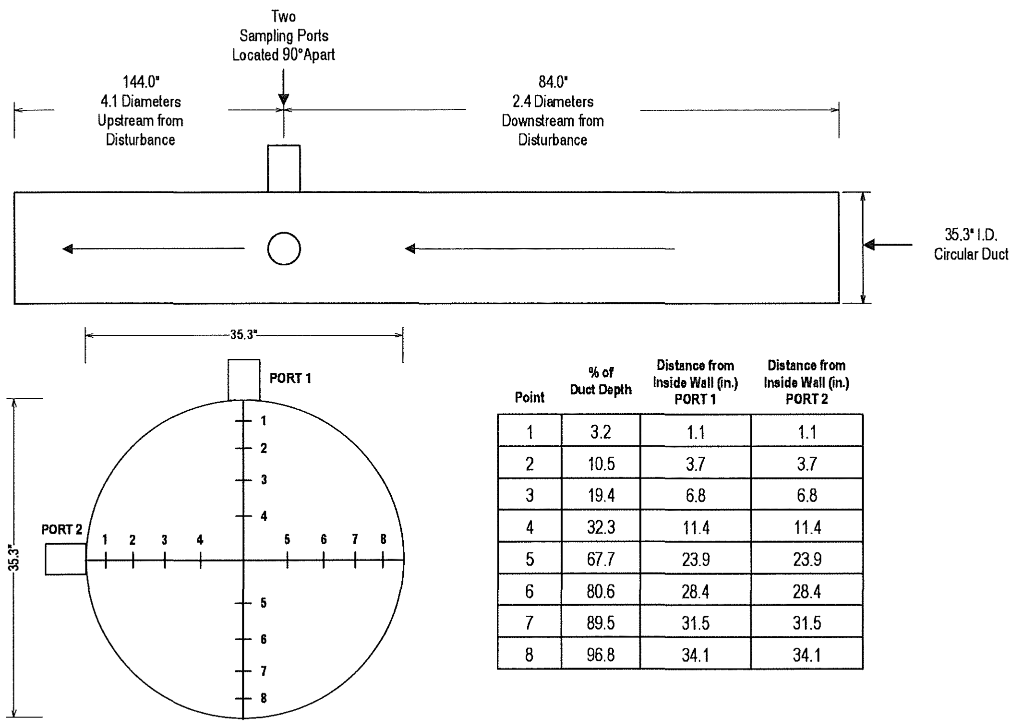
FIGURE4-11
RTO 2000 EXHAUST CEMS TRAVERSE POINT LOCATION DRAWING





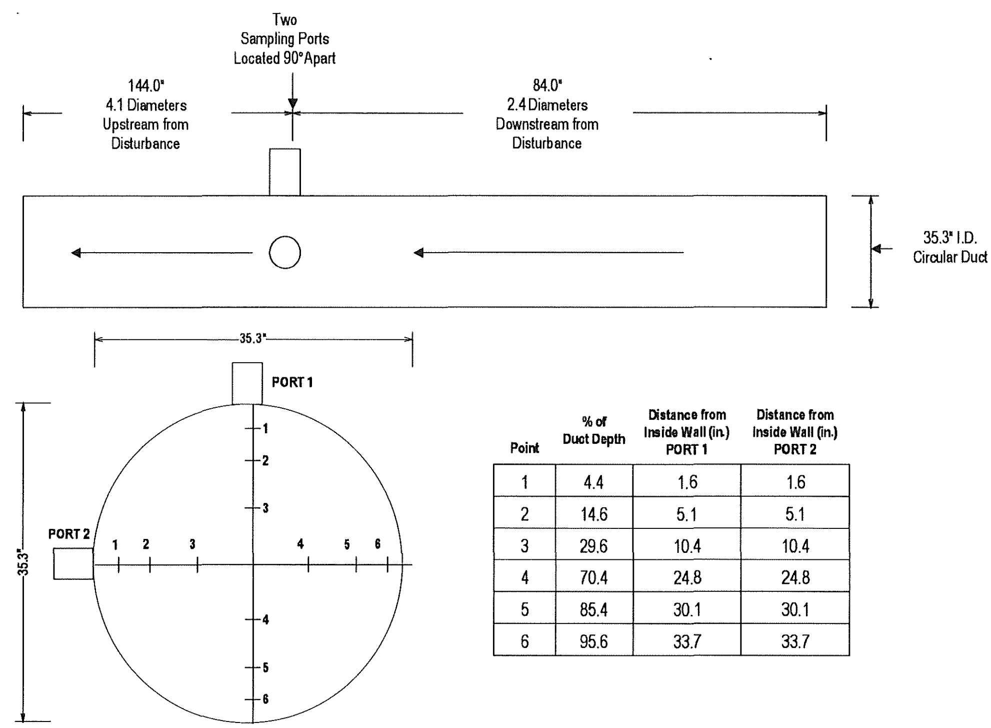
Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	2.2	2.2
2	14.6	7.2	7.2
3	29.6	14.6	14.6
4	70.4	34.7	34.7
5	85.4	42.1	42.1
6	95.6	47.1	47.1

FIGURE4-12
RTO 3000 INLET FLOW TRAVERSE POINT LOCATION DRAWING



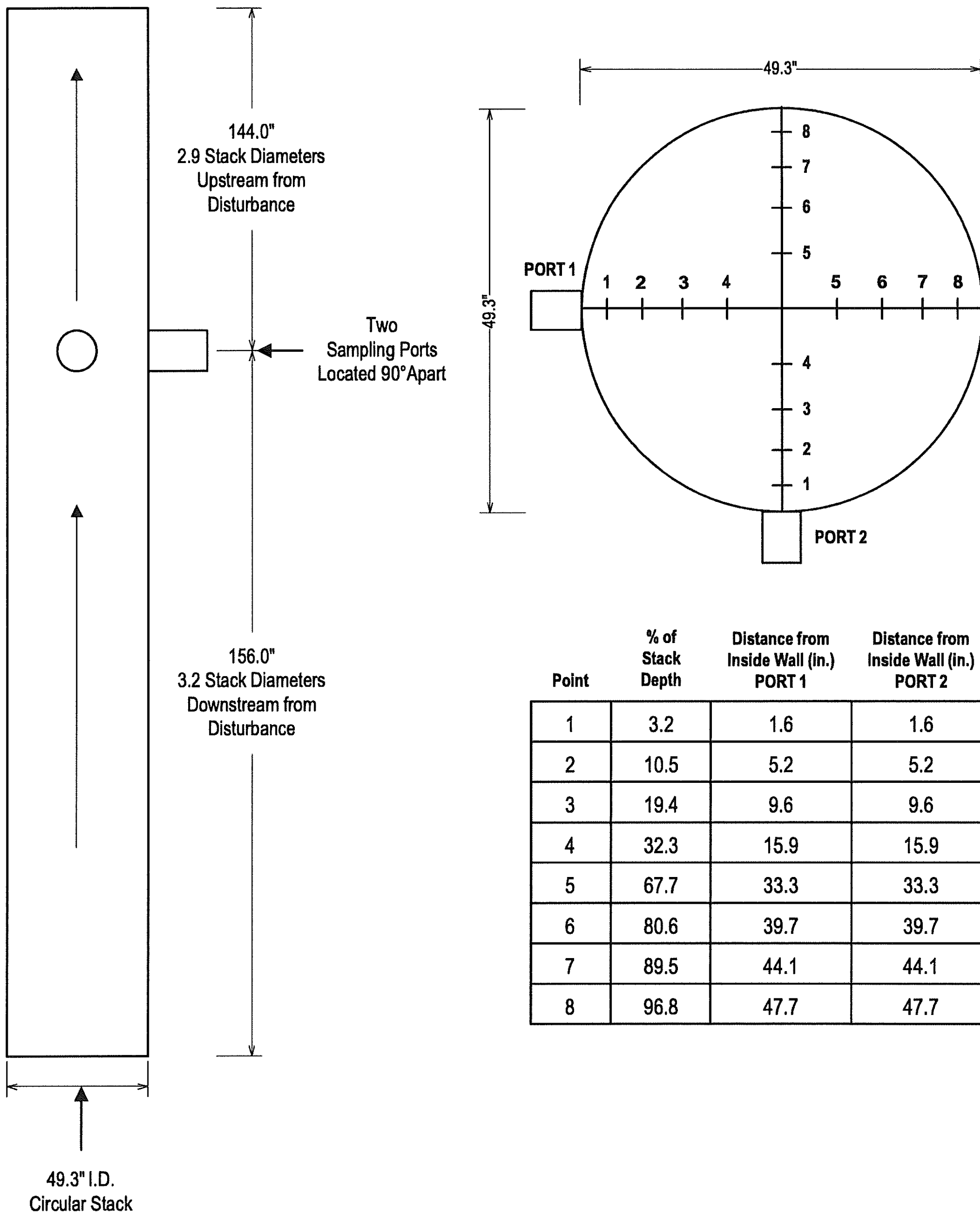
Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	1.1	1.1
2	10.5	3.7	3.7
3	19.4	6.8	6.8
4	32.3	11.4	11.4
5	67.7	23.9	23.9
6	80.6	28.4	28.4
7	89.5	31.5	31.5
8	96.8	34.1	34.1

FIGURE4-13
RTO 3000 INLET CEMS TRAVERSE POINT LOCATION DRAWING



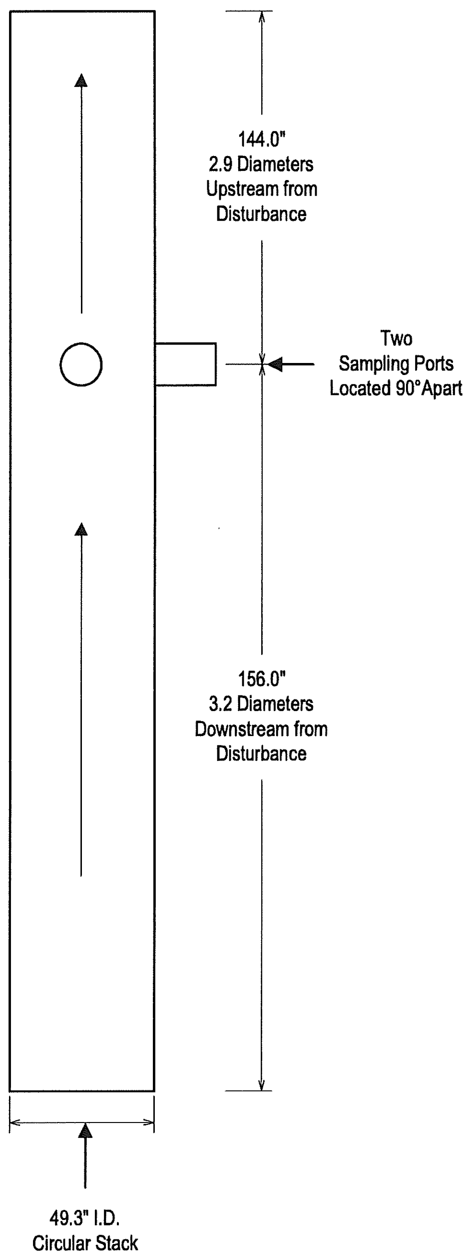
Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	1.6	1.6
2	14.6	5.1	5.1
3	29.6	10.4	10.4
4	70.4	24.8	24.8
5	85.4	30.1	30.1
6	95.6	33.7	33.7

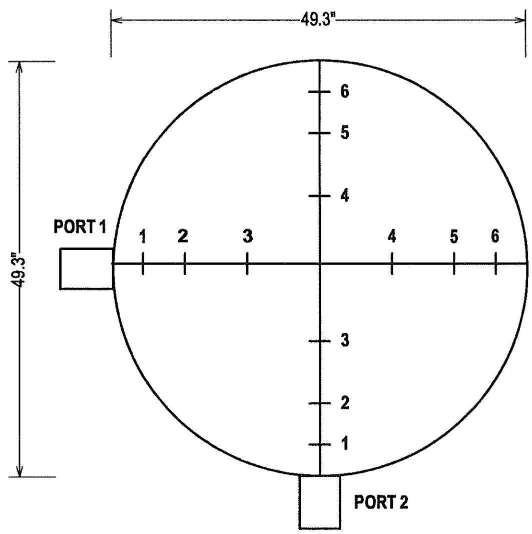
FIGURE4-14
RTO 3000 EXHAUST FLOW TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	1.6	1.6
2	10.5	5.2	5.2
3	19.4	9.6	9.6
4	32.3	15.9	15.9
5	67.7	33.3	33.3
6	80.6	39.7	39.7
7	89.5	44.1	44.1
8	96.8	47.7	47.7

FIGURE4-15
RTO 3000 EXHAUST CEMS TRAVERSE POINT LOCATION DRAWING





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	2.2	2.2
2	14.6	7.2	7.2
3	29.6	14.6	14.6
4	70.4	34.7	34.7
5	85.4	42.1	42.1
6	95.6	47.1	47.1

4.3 PROCESS TEST METHODS

Fuel Samples were collected by Ford Motor Company-Wing A Dynamometer Laboratory personnel and submitted for fuel analysis by Montrose personnel. See Appendix B.1 for fuel sample analysis.

5.0 TEST DISCUSSION AND RESULTS

5.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

During the first Run 1 at RTO 1000, only 3 engines were operating in idle mode. As a result the run was voided and an additional run, Run 4 was performed. The results of Run 1 are not included in this test report.

5.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Table 2-1. The results of individual compliance test runs performed are presented in Tables 5-1 through 5-6. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

Concentration values in 5-4 and 5-6 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method. Emissions denoted with a '<' in Tables 2.1, 5-4, and 5-6 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

The lb/MMBtu emissions for NOx, CO, and VOC were determined using MMBtu/hr values provided by Ford Motor Company-Wing A Dynamometer Laboratory personnel.

TABLE 5-1
EMISSIONS RESULTS -
RTO 1000 INLET

Run Number	2	3	4	Average
Date	07/09/2020	07/09/2020	07/09/2020	--
Time	09:27-10:32	11:02-12:07	12:40-13:45	--
Flue Gas Parameters				
O_2, % volume dry	20.0	20.0	20.0	20.0
CO_2, % volume dry	1.00	1.00	1.00	1.00
O_2, % volume dry	107	113	117	112
CO_2, % volume dry	3.29	3.14	2.36	2.93
flue gas temperature, °F	9,240	9,308	10,965	9,837
CO				
ppmvd	1,358	1,868	2,248	1,824
lb/hr	54.7	75.8	107.5	79.4
VOC (TGO) (as Propane)				
ppmvw	92.8	68.5	66.0	75.8
lb/hr	6.09	4.52	5.09	5.23

TABLE 5-2
EMISSIONS RESULTS -
RTO 1000 EXHAUST

Run Number	2	3	4	Average
Date	07/09/2020	07/09/2020	07/09/2020	--
Time	09:27-10:32	11:02-12:07	12:40-13:45	--
Process Data-Fuel Usage*				
MMBtu/hr	1.25	1.71	2.00	1.65
Flue Gas Parameters				
O_2, % volume dry	19.8	19.6	19.6	19.7
CO_2, % volume dry	0.63	0.76	0.78	0.73
flue gas temperature, °F	209	213	227	216
moisture content, % volume	4.09	3.80	4.34	4.08
volumetric flow rate, dscfm	9,730	9,402	9,150	9,427
NOx				
ppmvd	37.2	40.6	29.7	35.8
lb/hr (as NO_2)	2.59	2.73	1.95	2.42
lb/MMBtu (as NO_2)	2.08	1.60	0.97	1.55
CO				
ppmvd	34.4	43.7	53.0	43.7
lb/hr	1.46	1.79	2.11	1.79
lb/MMBtu	1.17	1.05	1.05	1.09
CO Destruction Efficiency (DE)				
%	97.3	97.6	98.0	97.7
TGO (as Propane)				
ppmvw	13.4	12.4	11.9	12.5
Methane (as Propane)				
ppmvw	11.0	10.5	10.0	10.5
VOC (as Propane)				
ppmvw	2.37	1.84	1.92	2.04
lb/hr	0.17	0.12	0.13	0.14
lb/MMBtu	0.13	0.072	0.063	0.089
VOC (TGO) Destruction Efficiency (DE)				
%	97.3	97.3	97.5	97.4

* Process data provided by Ford Motor Company-Wing A Dynamometer Laboratory personnel

TABLE 5-3
EMISSIONS RESULTS -
RTO 2000 INLET

Run Number	1	2	3	Average
Date	07/08/2020	07/08/2020	07/08/2020	--
Time	07:50-08:55	09:30-10:36	11:15-12:20	--
Flue Gas Parameters				
O_2, % volume dry	20.0	19.5	19.0	19.5
CO_2, % volume dry	1.00	1.00	1.00	1.00
flue gas temperature, °F	112	116	118	116
moisture content, % volume	4.56	3.85	4.59	4.33
volumetric flow rate, dscfm	9,080	8,321	7,781	8,394
CO				
ppmvd	2,706	3,037	2,854	2,866
lb/hr	107	110	96.9	104.8
VOC (TGO) (as Propane)				
ppmvw	64.8	41.9	48.2	51.6
lb/hr	4.23	2.49	2.70	3.14

TABLE 5-4
EMISSIONS RESULTS -
RTO 2000 EXHAUST

Run Number	1	2	3	Average
Date	07/08/2020	07/08/2020	07/08/2020	--
Time	07:50-08:55	09:30-10:36	11:15-12:20	--
Process Data-Fuel Usage*				
MMBtu/hr	1.69	1.30	2.04	1.67
Flue Gas Parameters				
O_2, % volume dry	19.5	19.5	19.5	19.5
CO_2, % volume dry	0.85	0.89	0.91	0.88
flue gas temperature, °F	224	235	239	233
moisture content, % volume	4.96	4.28	4.52	4.59
volumetric flow rate, dscfm	9,165	9,560	9,596	9,440
NOx				
ppmvd	30.3	26.9	29.0	28.8
lb/hr (as NO_2)	1.99	1.85	2.00	1.94
lb/MMBtu (as NO_2)	1.18	1.42	0.98	1.19
CO				
ppmvd	57.9	59.5	53.8	57.1
lb/hr	2.32	2.48	2.25	2.35
lb/MMBtu	1.37	1.92	1.10	1.46
CO Destruction Efficiency (DE)				
%	97.8	97.7	97.7	97.8
TGO (as Propane)				
ppmvw†	<2.00	<2.00	<2.00	<2.00
Methane (as Propane)				
ppmvw†	<0.84	<0.84	<0.84	<0.84
VOC (as Propane)				
ppmvw†	<1.16	<1.16	<1.16	<1.16
lb/hr†	<0.077	<0.080	<0.080	<0.079
lb/MMBtu†	<0.05	<0.06	<0.04	<0.05
VOC (TGO) Destruction Efficiency (DE)				
%	>98.2	>96.8	>97.0	>97.3

* Process data provided by Ford Motor Company-Wing A Dynamometer Laboratory personnel

† The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) of the analytical method. See Section 5.2 for details.

TABLE 5-5
EMISSIONS RESULTS -
RTO 3000 INLET

Run Number	**1**	**2**	**3**	**Average**
Date	07/07/2020	07/07/2020	07/07/2020	--
Time	08:57-10:02	10:35-11:41	12:15-13:20	--
Flue Gas Parameters				
O_2, % volume dry	20.0	20.0	20.0	20.0
CO_2, % volume dry	1.00	1.00	1.00	1.00
flue gas temperature, °F	111	115	117	114
moisture content, % volume	3.86	4.24	3.53	3.87
volumetric flow rate, dscfm	9,274	10,466	11,441	10,394
CO				
ppmvd	1,787	2,296	1,959	2,014
lb/hr	72.3	104.8	97.8	91.6
VOC (TGO) (as Propane)				
ppmvw	94.2	70.5	68.4	77.7
lb/hr	20.0	20.0	20.0	20.0

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**TABLE 5-6
EMISSIONS RESULTS -
RTO 3000 EXHAUST**

Run Number	1	2	3	Average
Date	07/07/2020	07/07/2020	07/07/2020	--
Time	08:57-10:02	10:35-11:41	12:15-13:20	--
Process Data-Fuel Usage*				
MMBtu/hr	1.38	2.33	1.65	1.79
Flue Gas Parameters				
O_2, % volume dry	19.6	19.8	19.8	19.7
CO_2, % volume dry	0.69	0.65	0.62	0.66
flue gas temperature, °F	206	209	206	207
moisture content, % volume	3.93	4.33	3.64	3.97
volumetric flow rate, dscfm	9,250	9,296	9,060	9,202
NOx				
ppmvd	44.9	32.2	28.3	35.1
lb/hr (as NO_2)	2.98	2.14	1.84	2.32
lb/MMBtu (as NO_2)	2.15	0.92	1.11	1.40
CO				
ppmvd	39.2	47.5	44.5	43.8
lb/hr	1.58	1.93	1.76	1.76
lb/MMBtu	1.15	1.15	1.15	1.15
CO Destruction Efficiency (DE)				
%	97.8	98.2	98.2	98.1
TGO (as Propane)				
ppmvw†	<2.00	5.82	6.57	<4.80
Methane (as Propane)				
ppmvw†	<0.85	5.7	7.9	<4.80
VOC (as Propane)				
ppmvw†	<1.15	0.61	0.0	<0.59
lb/hr†	<0.076	0.04	0.0	<0.04
lb/MMBtu†	<0.08	0.04	0.0	<0.04
VOC (TGO) Destruction Efficiency (DE)				
%	>98.8	>99.2	>99.9	>99.0

* Process data provided by Ford Motor Company-Wing A Dynamometer Laboratory personnel

† The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) of the analytical method. See Section 5.2 for details.